

Water Shortages

August 01, 2003

Abstract

By [Mary H. Cooper](#)

Is there enough fresh water for everyone?

More than a billion people around the world lack access to safe drinking water, and their numbers are growing. To make matters worse, 40 percent of Earth's inhabitants — nearly 3 billion people — have no sanitation services, often forcing them to sully the little fresh water they have. In the United States, copious rains finally have brought relief to many water-starved parts of the country, but the West and Southwest continue to suffer from last year's severe drought. The drought has intensified the ongoing struggle between thirsty urban centers in the West and rural communities fighting cities' efforts to tap their pristine rivers. Environmentalists say conservation can alleviate the water shortages, but others contend privatization of water supplies and more investment in technology offer the most hope.



Women carry water from water holes in a dry lake west of Ahmadabad, India, on June 6, 2003. A heat wave is blamed in the deaths of more than 1,300 people in the southern Indian state of Andhra Pradesh. (AP Photo/Siddharth Darshan Kumar)

Overview

Imagine trying to sip water through a straw from a glass across the room. That's essentially what is being proposed to quench the growing thirst of the bustling Colorado cities on the eastern slope of the Rocky Mountains.

The “Big Straw” project would take water from the Colorado River in western Colorado and pump it 300 miles to Denver and its sprawling suburbs, tunneling through the 10,000-foot-high Continental Divide.

Environmental advocates have pounced on the massive project as yet another water boondoggle. “I've never heard anyone tell me with a straight face that the Big Straw can be built in a way that is economically viable,” says Carrie Doyle, Denver program manager for the League of Conservation Voters, an environmental advocacy group. She says the project, and other shorter “straws” also under consideration in Colorado, would wreak havoc on the state's environment and vital tourist economy. “One of the main reasons why people choose to visit and live in Colorado is

that we like our mountains, and that includes mountains with water running in streams.”

Even supporters of the project have doubts about the Big Straw's prospects. “Technologically, it's feasible,” says Peter Binney, director of utilities for Aurora, a Denver suburb. “But I've got major questions in my mind about whether it's practical or environmentally and economically feasible.”



Rafters ride the Arkansas River near Salida, Colo. Efforts by Denver and other eastern Colorado cities to divert more of the river's waters have been criticized by environmentalists and local whitewater-rafting outfitters, who warn that depleting the river further will threaten the mountain river ecosystem. AP Photo/Ed Andrieski

The impetus for eastern Colorado's desperate effort to find new sources of fresh water, of course, is a three-year drought that has parched most of the region. While droughts are common in that part of the country, this one is being exacerbated by a rapid population increase that has left communities with chronic water shortages. [\[1\]](#)

“Last year was the worst year of drought in 300 years,” says John Keys, commissioner of the Bureau of Reclamation, the U.S. Interior Department agency that manages water projects in the West.

The drought has intensified an ongoing struggle between thirsty cities and the ranchers and rural communities that oppose efforts to tap into their pristine rivers. The Interior Department recently issued a report identifying several dozen areas, including regions along the Mexican and Canadian

borders, where water disputes could spark local, interstate and international crises over the next 25 years. [\[2\]](#)

As serious as they are, water shortages in the Western United States pale in comparison with problems facing other parts of the world. According to the United Nations, 1.1 billion people worldwide lack access to safe drinking water. Lack of sanitation makes matters worse by polluting existing sources of potable water. “Forty percent of the world's population — that's 2.4 billion people — lack access to sanitation services, which leads to hundreds of millions of cases every year of water-related diseases,” says Peter H. Gleick, president of the Pacific Institute for Studies in Development, Environment and Security. “The world's biggest problem today is our failure to meet the basic need for water for billions of people.”

Moreover, water shortages are bound to increase in coming years unless major changes are made in how water is provided and disposed of, experts say. Humans already extract 54 percent of all the accessible fresh water contained in rivers, lakes and underground aquifers, according to the United Nations. The U.N. predicts that if per-capita water consumption continues to rise at current rates, humans will take more than 90 percent of all available fresh water by 2025, leaving just 10 percent for all other animals and plants. [\[3\]](#)

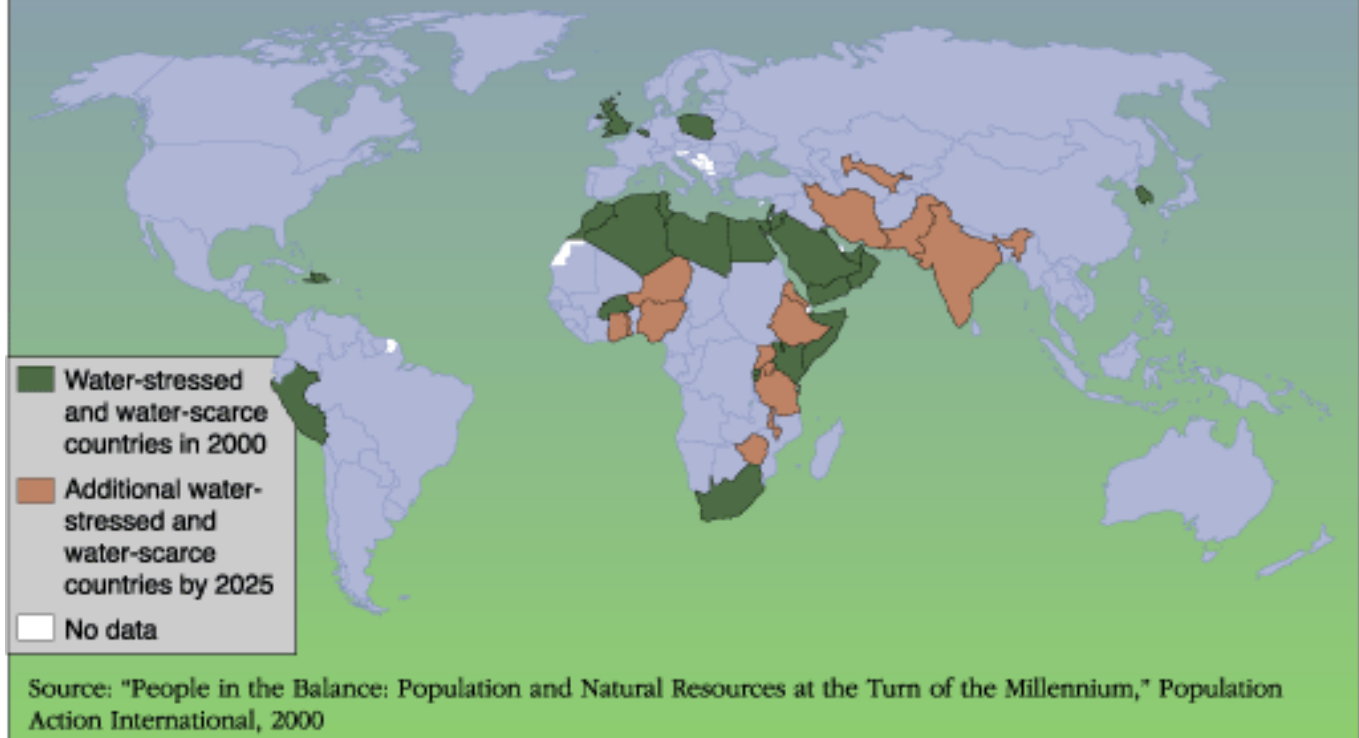
At the same time, the number of people without adequate access to fresh water is expected to grow from 434 million today to between 2.6 billion and 3.1 billion by 2025, according to Population Action International, a nonprofit group that studies global population growth. Correspondingly, the number of countries afflicted with poor access to water is expected to grow from 25 today to between 36 and 40 by 2025.

Water scarcity may seem unlikely for a planet that, viewed from space, looks like a cloud-swept blue ball. Indeed, with water covering nearly three-quarters of Earth's surface, it's easy to take water supplies for granted. But while water is the most abundant substance on Earth, 97.5 percent of it is salt water, virtually useless for most human needs. Two-thirds of the fresh water, furthermore, is locked up in glaciers and permanent snow cover. That leaves barely 1 percent of all the water on Earth available for human use. [\[4\]](#)

Water Shortages Expected to Spread

Water shortages are expected to affect up to 40 nations — mostly in Africa and western Asia — in 2025, compared with 25 nations in 2000. However, because world population growth is slowing significantly — largely due to greater use of family planning — future water shortages are expected to be less severe than earlier projections.

Water Scarcity in 2000 and 2025



Population growth and economic development have placed increasing stress on available water supplies in many parts of the world. The global population has more than doubled over the past half-century to more than 6 billion people. In addition to consuming more water directly for household use, growing populations also require more water to grow food and produce manufactured goods. Almost 70 percent of all water taken for human consumption is used to irrigate crops. Population growth and development also produce water pollution, which further diminishes available water supplies.

“Water problems around the world are more than just shortages,” Gleick says. “There are problems with water quality; physical shortages, where there just isn't enough; economic shortages, where people can't get to the water resources they need; and there are political shortages, where water is denied to people. There are many different pieces to this puzzle.”

Although last year's severe, almost nationwide, drought has disappeared in the East and Midwest,

thanks to abundant rainfall, its persistence in the West and desert Southwest is forcing residents to change their water-consumption habits. Many local governments have restricted car washing and lawn watering, and some encourage homeowners to replace their grass with less thirsty native plants. [5]

“The drought is an acute problem, but it's finally getting people to start realizing that we've got a more chronic problem out here,” utilities Director Binney says. “There now is a consciousness that water is a fixed resource and that we have to be more mindful of how we're using it.”

The scarcity of water throughout the West has prompted lawmakers to consider strengthening the federal government's role in managing water supplies, traditionally a matter of state and local responsibility. A bill before Congress would create a new National Water Commission to coordinate state and local water policy.

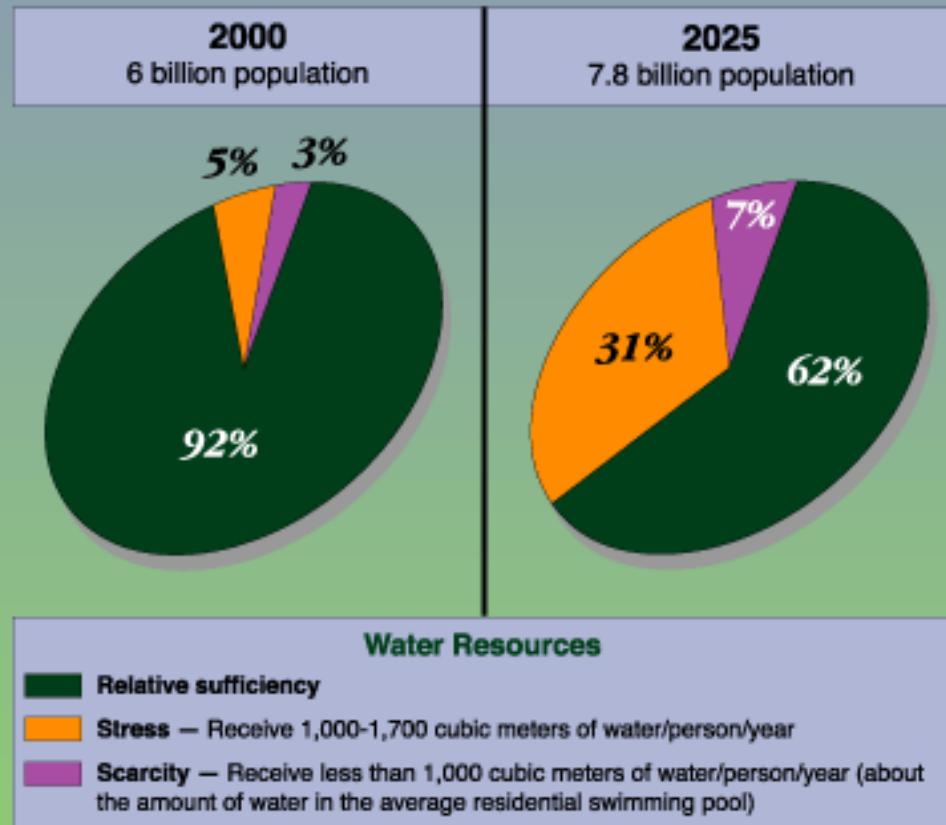
Finding solutions to water shortages is complicated by the fact that many past solutions are no longer viable. For example, for decades the World Bank and other international lenders built scores of large dams around the world to store water and generate electricity, as did the U.S. Bureau of Reclamation in the Western United States. But most of the rivers deemed suitable for large water projects already have been dammed, and critics complain that dams damage the environment. Instead, environmentalists say, improving conservation is a cheaper, more sustainable way to ensure adequate supplies.

International institutions are raising the alarm over the world's dwindling water supply — a problem that has historically taken a backseat to arms control, peacekeeping, trade and other thorny international matters. The United Nations declared 2003 as the “International Year of Freshwater” and sponsored a recent conference in Kyoto, Japan, to identify effective approaches to improving access to safe water. Proposals include broader privatization of water utilities and more investment in technologies to turn seawater and glaciers into usable fresh water. But both solutions are controversial. Critics of privatization defend access to free water as a human right, and many environmental advocates say conservation would increase water supplies far more efficiently than any technological fix.

More People to Face Shortages

Nearly 40 percent of the world's population — about 3 billion people — will face shortages of fresh water by 2025 — six times the number who experienced shortages in 2000. Most of the shortfall will be in areas with high population growth and limited rainfall.

Fresh Water Availability in 2000 and 2025 (by percentage of world's population)



Source: "People in the Balance: Population and Natural Resources at the Turn of the Millennium," Population Action International, 2002

"The world is lumbering toward solutions to water scarcity," says Robert Engelman, vice president for research at Population Action International. "Governments are rather ham-handed in their efforts, but at least their intentions are good. They increasingly are recognizing that solving the water-scarcity problem is fundamental to the future of economic and human development in the 21st century."

As scientists and policymakers seek to increase access to water, these are some of the questions they are asking:

Does privatization help the world's poor gain access to water supplies?

Unlike the vast majority of natural resources, water often is seen as a free commodity, akin to the air we breathe. “Water is free in much of the world, where you can just dig a well and pull it out of the ground,” says Engelman of Population Action International. “Even where utilities provide the water, in many countries — including until recently the United Kingdom — you may pay an annual fee to be plugged into the system, but it doesn't matter how much water you use.”

Based on that experience, non-governmental organizations and citizens' groups around the world have declared that free access to clean water is a basic human right and condemned efforts to charge fees for water as the “commodification” of a basic natural resource. The debate intensified last October during the World Summit on Sustainable Development, held in Johannesburg, South Africa. In addition, activists bearing banners that read “World Water Mafia” and “Water Is a Human Right” stormed the stage at the Third World Water Forum in Kyoto in June. [\[6\]](#)



The controversial Lesotho Highlands Water Project will carry water from impoverished Lesotho to neighboring South Africa via tunnels. The foreign consortium that built the system did not resettle the 30,000 people its dams displaced. Courts in Lesotho convicted two of the firms of bribing government officials. AFP

Photo

Most experts contend that providing water free to all users is not a viable expectation in the face of today's dwindling supplies. “There is wisdom to pricing water because it's a well-known human trait that we don't conserve things that are free,” Engelman says. “Social activists at Johannesburg called for free water for the poor, saying there's more than enough water for everybody. On the

other hand, the World Bank and its member governments argued that unless people conserve, there won't be enough for everybody. Unfortunately, that's where the debate stands today.”

The Pacific Institute's Gleick says a key fact that often goes unrecognized in the pricing debate is the cost of maintaining the very utility systems that ensure people's access to safe water. “I think of water not as a commodity, but as an economic good, so there are certain economic principles that ought to be applied in managing water systems,” he says. “Water services shouldn't be free. If people don't pay for it, then there's no money to operate and maintain high-quality systems. Those things cost money.”

In recent decades, many countries have started charging people for the water they use. A study of industrial countries found that prices vary widely, reflecting the cost of storing, treating and transporting water to customers — from \$1.91 per cubic meter in highly urbanized Germany to 51 cents in the United States and just 40 cents in Canada, whose vast water resources serve a relatively small population. [7]

The issue of who should control water resources is even more contentious. [8]For centuries, governments traditionally have had responsibility for providing water. But increasingly, they are handing over at least part of the job to private companies. Some of these are large multinational corporations, such as France's Ondeo, which provides water to more than 110 million people in 130 countries, and Britain's Thames Water, which has some 70 million customers in 46 countries.

But critics of privatization say corporate mismanagement and corruption have transformed some private water-development projects into poster children for the anti-privatization movement. The Lesotho Highlands Water Project, a multi-dam system in the small, impoverished country adjoining South Africa, is often cited as a case in point. The largest project of its kind in Africa, it being built and managed by a consortium of foreign companies to collect water in Lesotho and transport it to South Africa. The reservoirs created by its dams displaced more than 30,000 people, and promises to use part of the project's profits to help them relocate have not been honored. After repeated allegations of corruption and mismanagement, courts in Lesotho convicted Canadian and German firms involved in the project of bribing government officials.

“The local people where the water has been diverted have been severely impoverished as a result of this project,” says Korinna Horta, senior economist at Environmental Defense, a U.S. advocacy

group. “There's all this water flowing out of their country, but they themselves have no access to it.”

In Horta's view, privatization threatens proper management of water resources. “Since private companies need to make profits, often the poorer people who can't afford to pay for the new water simply won't get it anymore,” she says. And, because most privatization efforts have been implemented without adequate regulations or government oversight, the water may no longer be available to all. “Private companies have no incentive to go into remote, rural areas unless they are forced to,” she says.

But the fight against privatization appears to be an uphill battle. “Privatization has been around for a long time in various forms,” says Gleick, who points out that France has had private water companies for 100 years, and 15 percent of Americans get their water from private utilities. [9] “There is private involvement in the water sector now, and there always will be,” he says. “But it's being applied improperly.”

In a report issued last year, Gleick and his colleagues listed several principles they say should be in place before any government turns over water supplies to private companies, including proper pricing, subsidies for the poor and strong government oversight. [10]

Governments that do not exercise oversight or ensure citizens' continued access to adequate water often doom utility privatization from the outset. When Bolivia invited a subsidiary of San Francisco-based Bechtel Corp. to take over water management in the city of Cochabamba, it failed to protect its poorest citizens from prohibitive water charges. Street demonstrations sparked by the high prices injured dozens of people and killed a young boy. Bechtel recently abandoned the project but sued the Bolivian government for \$25 million, claiming the loss of its expected profits amounted to an “expropriated investment.” A decision in the case is pending. [11]

Bolivia's experience offers a lesson for governments contemplating water privatization. “Private companies can operate and maintain water systems, but they should never own the water,” Gleick says. “Water is an economic good, but it's also a social good, and private companies will not protect social goods without strong government encouragement.”

Can technological advances ensure adequate water supplies?

Historically, technology has played the dominant role in expanding water supplies, from simple irrigation channels to the massive hydroelectric dams that exemplified the predominant 20th-century approach to water management, including the recently completed Three Gorges Dam in China. However, most of the economically feasible locations for big dams have now been developed.

Massive water projects also have fallen out of favor because of their record of huge cost overruns and failure to help needy populations. “In general, the megaprojects have not done much to improve water access for poor people,” says Horta of Environmental Defense. “Indeed, the people most directly affected through displacement have actually suffered.” Citing the Lesotho Highlands Water Project, Horta says, “Cost overruns are typical of these projects, but in this case they're so large that it's unclear if they will halt construction altogether.”

While megaprojects generally are no longer being built in the United States, the Bureau of Reclamation still provides water to 30 million people and 10 million acres of irrigated land that produces 60 percent of U.S. vegetables and a quarter of its fruit. It also manages 58 power plants that generate enough electricity for 9 million people, and numerous marinas and other recreational facilities surrounding the reservoirs created by those dams. “We still have a definite mission in the world of water resources,” says Commissioner Keys.

However, there are alternatives to big dams for enhancing water supplies. Because salt water accounts for more than 97 percent of the Earth's available water, desalination technology sometimes offers a viable solution. Many countries with limited fresh water and access to seawater — including the United States, South Africa and Israel — have built desalination plants. [\[12\]](#) But because of its high cost, the technology is used primarily to produce drinking water alone.

“Desalination is capital-, labor- and energy-intensive,” Engelman says. “While in theory there are lots of possibilities for desalination, particularly for wealthy seacoast towns, it's not the answer to water scarcity in much of Africa or the Middle East because many of the places where water is scarce are simply too far from the sea. Also, these places typically don't have the resources to desalinate and transport the water they need.”

Japan has taken the lead in researching new freshwater technology. It is building a combination desalination and electricity-generating plant in the Pacific island nation of Palau. [\[13\]](#) Low-lying

islands like Palau are especially vulnerable to rising sea levels caused by global warming: Saltwater contaminates underground aquifers and encroaches on coastal settlements.

More-fanciful technologies to increase water supplies are being developed, including breaking off huge chunks of polar ice and towing them to thirsty parts of the world and even probing space for new water sources.

Many experts contend, however, that conservation offers greater promise than any new technology for ensuring adequate supplies of water. In Gleick's view, industries and commercial buildings could save 40 percent of the water they use just by adopting existing technologies. “The most effective solution to water problems in the United States is water conservation and efficiency,” Gleick says. “It's the cheapest, fastest and cleanest way of meeting our needs for water.”

Moreover, Gleick says, the government could encourage conservation simply by eliminating water subsidies for irrigation, hydropower and household use that were introduced in the early 20th century to encourage settlement of the West. Today, as retirees and others migrate to Phoenix, Albuquerque and other burgeoning cities in the desert Southwest — threatening to overwhelm the region's water supply — the need for incentives is gone, he says. Most of the areas where the Interior Department says water conflicts are likely to arise by 2025 are located in this region.

But meaningful conservation programs will require overturning longstanding practices. “The 20th century was really a century of water engineering,” Gleick explains. “Water planners and managers are trained to think like engineers. From an engineering point of view, it's much easier to build a dam to [serve] 100,000 people than to deal with the individual water uses of 100,000 people. That's a harder thing, and it requires a different set of tools and skills.”

Should the federal government play a bigger role in U.S. water policy?

In the United States, water-supply policymaking primarily falls within state and local jurisdiction. The federal government's most direct role involves the Bureau of Reclamation's construction and management of major water-storage facilities in the West. The other federal agency involved in water-use policy, the U.S. Army Corps of Engineers, focuses mainly on construction of navigation and flood-control projects throughout the country. [\[14\]](#)

Water Prices Vary	
Among developed countries, Canada has the cheapest water and Germany the costliest.	
Water Prices in Developed Countries	
Country	\$/cubic meter
Germany	\$1.91
Belgium	1.54
Netherlands	1.25
France	1.23
United Kingdom	1.18
Italy	0.76
United States	0.51
Australia	0.50
South Africa	0.47
Canada	0.40
Source: "Water for People, Water for Life," United Nations World Water Development Report, March 2003	

The federal government also influences freshwater accessibility through its enforcement of the 1974 Safe Drinking Water Act and the 1977 Clean Water Act. It also can halt or alter environmentally destructive water projects under the 1973 Endangered Species Act. Finally, the federal government is responsible for honoring treaties with Canada and Mexico involving trans-border water flows.

Recent droughts and predictions of coming water shortages, especially in the West, have prompted reconsideration of the federal government's oversight of the nation's water supplies. In June, an Interior Department report warned of coming water conflicts in many parts of the West unless innovative steps are taken to augment the region's supplies. The "Water 2025" report recommended that states set up voluntary "water banks" that would enable growers to rent their excess water to municipalities or other users during droughts.

But the report stopped short of advocating a major federal role in such endeavors, beyond helping pay for research into water-saving technologies. "There's no one-size-fits-all policy for water," said Interior Secretary Gale Norton in releasing the report. [\[15\]](#)

Although 35 states have begun developing long-term drought-preparedness plans in recent years, some experts say the threat of water scarcity is too critical to leave water policy to an ad-hoc, state-by-state approach. “There has never been a lead federal agency dealing with drought, and that is part of the problem both from a response and a planning perspective,” says Don Wilhite, director of the National Drought Mitigation Center at the University of Nebraska, Lincoln, which develops plans for drought preparedness and tracks precipitation trends for the federal government.

[16]“What one state does with water is going to affect multiple other states, and interstate compacts now in place are continuously being challenged in the courts. Drought is a regional phenomenon; it doesn't confine itself to national, much less state, boundaries, so there is a problem with overlapping authorities.”

Some lawmakers agree that greater federal oversight is in order, especially with regard to drought preparedness. Sens. Max Baucus, D-Mont., and Pete V. Domenici, R-N.M., plan to reintroduce this year a bill they cosponsored last year, the National Drought Preparedness Act, which would establish a national drought council within the Federal Emergency Management Agency (FEMA) to develop a nationwide drought policy. Another bill, the 21st Century Water Commission Act, introduced this year by Rep. John Linder, R-Ga., would create a national water commission to coordinate water management and encourage the development of a comprehensive water policy to avoid future shortages.

Linder and other supporters of an enhanced federal oversight of water policy say they have no intention of infringing on the states' control over water. But efforts to strengthen the federal government's water policy decision-making powers may spark resistance at the state and local levels, especially in the West, where water rights and the authority to write water law are jealously guarded assets.

Indeed, states have long resisted the existing federal role in water issues, especially when federal enforcement of the Endangered Species Act has reduced localities' access to water. On June 12, the 10th U.S. Circuit Court of Appeals ruled that the Bureau of Reclamation must consider the effect on the endangered silvery minnow when it releases water from its San Juan-Chama Diversion Project, which supplies water to Albuquerque. The ruling prompted city officials to vow to fight the ruling, saying it would endanger the city's right to water it already has purchased. The city buys the rights to water piped from the Colorado River basin through the project's pipeline for

municipal use. Sen. Domenici subsequently introduced legislation to block the taking of water from cities and farmers to protect the fish, as required under the Endangered Species Act. [17]

Similarly heated debates are taking place in the Pacific Northwest, where more than 20,000 salmon died during last summer's drought after the Bureau of Reclamation diverted Klamath River water to irrigate fields in Oregon and California. [18]

Efforts to better coordinate drought preparedness and create policies to improve water supplies may encounter similar obstacles if they are seen as infringing on traditional water rights.

“We own the water rights, we own the revenue stream and we own the facilities that move the water out here, so we're the ones who should be solving the problem,” says Aurora, Colo., utilities Director Binney. “We're already actively involved with the federal government through the Bureau of Reclamation and in the implementation of the Endangered Species Act, which has a big impact on water development.

“I think the next generation of water projects will be developed at the local level,” he continues, “and the state and federal governments will act more as regulators or facilitators.”

Background

Key to Civilization

Modern human history often boils down to the struggle for access to clean water. Archeological discoveries record evidence of this quest beginning some 20,000 years ago. Even before the invention of pottery, hunter-gatherers fashioned water containers out of ostrich eggshells or wood in order to reach hunting grounds far from streams and lakes. [19]

Civilization developed as a direct result of new advances in water management. Settlement of major river valleys such as the Tigris and Euphrates in Iraq and the Nile in Egypt occurred after humans discovered they could cultivate cereals and domesticate animals close to waterways and channel the flow into irrigation ditches to ensure a steady food supply without leaving home. Permanent settlement gave rise to an increasingly complex division of labor that would evolve into modern nation-states and political systems.

From eggshell canteens to today's massive hydroelectric dams, advances in water technology have driven human progress, primarily in boom-bust cycles. For instance, ancient Persians' discovery of a way to tap desert groundwater and deliver it to settlements through underground tunnels prompted a jump in population that eventually overwhelmed both the supply and quality of available water, resulting in sickness and famine.

This seemingly relentless cycle is the central paradox of water management. “[W]ater shortages have been an engine of human innovations: propelling, motivating and prodding societies to devise, accept and perpetuate solutions to water scarcity,” wrote Fekri A. Hassan, an archeologist at University College, in London. “Water is thus the mainspring of civilization. However, . . . relief mechanisms always entailed . . . greater demands for water than what is available.” [\[20\]](#)

Because it is essential to life, water also has been a target and even a weapon in military conflicts. As early as 596 BC, the Babylonian king Nebuchadnezzar conquered the Phoenician city of Tyre by breaching the city's aqueduct. In 1938, Gen. Chiang Kai-shek ordered the dismantling of dikes on China's Yellow River to flood areas threatened by invading Japanese forces — slowing the invasion but killing hundreds of thousands of Chinese in the process. U.S. forces bombed many dikes during the Vietnam War, causing floods and starvation that Vietnam claims killed up to 3 million people. [\[21\]](#)

Agriculture, industrialization and population growth have intensified water use over the millennia. Indeed, about 70 percent of all available fresh water today is used for irrigation. Food products vary widely in the amount of water needed to grow, ranging from just one cubic meter per kilo of potatoes, for example, to 15 cubic meters to produce a kilo of beef. Because livestock production consumes far more water per unit than cereals or produce, the growing consumption of meat that has helped improve nutrition in developing countries has also contributed to their water-supply problems. Industrial technologies also consume varying amounts of water. Some basic manufacturing sectors, such as the steel industry, have developed methods to reduce their water usage, but newer industries — such as manufacturers of computer chips — require prodigious amounts of water, partially offsetting other conservation efforts.

Not only do agriculture and industry consume water, they also cause water pollution. As industrialization spreads, water pollution is becoming a growing threat to water supplies,

especially in the developing world, where 70 percent of industrial wastes are dumped untreated into rivers and lakes. [22]Some 2 million tons of human waste, fertilizers, pesticides and chemical and industrial wastes are released into waterways each day, according to the United Nations.

Finite Resource

Although the amount of fresh water on Earth is finite, most of it is considered a renewable resource because it constantly circulates in a pattern known as the hydrologic cycle. Water vapor in clouds condenses and falls as rain or snow, which then flows into streams, rivers, lakes and wetlands until it reaches the sea. Along the way, much of the water is taken up by plants and soil and evaporates into the atmosphere, forming clouds and starting the cycle all over again.

Some of the water also seeps into underground aquifers. But because many aquifers take decades to recharge, groundwater in many parts of the world is not considered a renewable resource. [23]

Humans have learned to manage water to their advantage by intervening in the cycle between the points where precipitation reaches the ground and fresh water empties into the sea. Over the millennia, they have built dikes to prevent flooding, dams to store precious water, canals to transport it to dry regions, irrigation systems to divert natural flows onto croplands, and myriad ways to collect and store rainwater and tap into aquifers. [24]



Dead salmon line the banks of the Klamath River near Klamath, Calif., last September. More than 20,000 salmon died during last summer's drought after the Bureau of Reclamation diverted river water to irrigate fields in Oregon and California. AP Photo/The Herald and News, Ron Winn

But growing population and improving living standards contribute to the world's steady decrease in freshwater supplies. In 1950, there were 2.5 billion people in the world. Today, there are 6.3 billion, and the United Nations predicts Earth's population will reach 8.9 billion by 2050. [25] As the number of water users skyrockets, the amount of water each person uses also increases. Both industrial and personal water use grows with the advent of indoor plumbing and other amenities.

Along with industrialization comes urbanization, as people move to cities to find industrial employment. Urbanization further depletes usable water supplies, because it concentrates waste in waterways in towns where sanitation and plumbing are lacking. Ironically, those who use the least amount of water are exposed to the most water pollution. Fully half the populations of developing countries are exposed to polluted water, the U.N. estimates. [26]

Pollution not only reduces the volume of accessible fresh water but also causes sickness and death

to those forced to use polluted water. Water-related illness is one of the most common causes of disease and death, chiefly in developing countries. Diarrhea, schistosomiasis and other preventable diseases caused by contaminated water killed more than 2 million people in 2000, most of them children under five. “In the vicious poverty/ill-health cycle, inadequate water supply and sanitation are both underlying cause and outcome,” the U.N. reports. “Invariably, those who lack adequate and affordable water supplies are the poorest in society.” [\[27\]](#)

Megaproject Heyday

The remains of dams built in the Middle East in 3000 BC reveal that humans have been storing water for millennia. But large-scale dam construction for water storage and hydroelectric power came of age in the 20th century. Often funded by the World Bank and other international lending and aid agencies, so-called megaprojects once were thought to be the key to propelling many poor countries into the modern age. Large hydroelectric dams would help control flooding and provide the electrical power needed to run factories and light homes, ensure reliable sources of water for irrigation and consumption in areas with sporadic rainfall.

From the 1930s to the '60s — the heyday of the megaprojects — dam construction accelerated, producing many of today's 45,000 large dams — a \$2 trillion investment. At the time, the benefits were widely considered to be well worth the enormous investment. Dam construction provided jobs; roads and bridges were built to access the dam sites; farmers gained reliable irrigation water and remote rural areas received electrical power. Indeed, dams currently generate about a fifth of the world's electricity, and supply more than a third of all the world's irrigation water. [\[28\]](#)



AFP Photo/Joel Robine



AP Photo/Anung

Drought's Devastation

Drought in Ethiopia caused widespread famine and killed thousands of cattle and other animals in recent years (top). Population growth in Ethiopia and other African nations is steadily reducing water flows in the Nile River, raising protests from Egypt. If water becomes scarcer, such disputes over access could escalate into conflict.

Indonesian children collect water from a spring in a dry riverbed in West Java (bottom). The island was hit hard by drought last year, forcing villagers to walk miles to find drinking water. More than 1 billion people in developing nations lack access to safe drinking water, according to the U.N.

But the hopes placed on dams as vehicles of development often fell short of expectations. Megaprojects in the 21st century displaced as many as 80 million people, many of whom encountered worse living conditions in their new villages. The dams changed the courses of more

than half of the world's rivers, disrupted natural habitats and caused irreparable environmental damage. And widespread corruption meant that the promised electrification often failed to extend beyond large towns and cities.

As the controversy over dam construction mounted in the 1990s, the World Bank began to scale back its support of megaprojects, withdrawing altogether from some of the more controversial projects, such as the vast Three Gorges Dam on China's Yangtze River.* In 1998, the international World Commission on Dams was established to assess the damage caused by massive water projects and consider alternatives.

The debate over megaprojects has produced a growing consensus on the need for smaller, less costly projects designed to meet the needs of local communities. Such projects emphasize reducing water consumption by fixing leaky conduits and pipes, covering open-air channels and conserving water with such low-technology methods as drip irrigation and public-education campaigns.

Making consumers pay for the water they use also increases water supplies, because it encourages conservation. This approach, even if it is coupled with government subsidies for the poor, has sparked criticism from many who consider free access to safe water a basic human right. Supply-side alternatives to dam building include desalination and reuse of treated water for irrigation, clothes washing and uses other than drinking.

Renewed Attention

The failure of large dam projects to solve water-shortage problems around the world also sparked renewed international attention to the issue. Over the past three decades, some 20 major international conferences have focused on clean water and sanitation.

The United Nations convened its first conference on water in 1977 at Mar del Plata, Argentina, which called for the creation of a global inventory of freshwater availability. In a further effort to focus wealthy nations' attention to the rapidly declining availability of fresh water in the developing world, the U.N. declared the 1980s the “International Drinking Water and Sanitation Decade.” Another water conference, held in 1992 in Dublin, Ireland, concluded that water “should be recognized as an economic good,” a principle that was hotly debated at the U.N. Conference on Environment and Development, also known as the UNCED Earth Summit, held later that year in

Rio de Janeiro, Brazil.

In 2000, the United Nations included as part of its Millennium Declaration a commitment “to halve, by the year 2015 . . . the proportion of people who are unable to reach or to afford safe drinking water.”

The debate over water as a human right and privatization of utilities intensified at the World Summit on Sustainable Development, held last October in Johannesburg, South Africa. [29] Most recently, in June, the Third World Water Forum, held in Kyoto, Japan, issued the World Water Development Report, a massive document spelling out the major impediments to global access to clean water. To call attention to the progressive dwindling of global water supplies, the United Nations also named 2003 the International Year of Freshwater.



Two-thirds of Earth’s fresh water is locked up in permanent snow cover and ice like Norway’s Briksdal Glacier (above). Global warming threatens to seriously reduce supplies of fresh water. As polar ice and glaciers melt, sea levels rise and cause coastal flooding that contaminates freshwater aquifers. Some Pacific islands already have been affected. AFP Photo

U.S. Water Puzzle

As a whole, the United States possesses abundant water supplies. For most of its history, the federal government — through the Army Corps of Engineers and the Bureau of Reclamation — has developed dams and flood-control projects that provide electricity and water storage for irrigation, industrial use and household consumption. Traditionally, the Corps has focused on

building and maintaining projects for navigation, flood control and power generation, while the Bureau's main goal has been to store water for irrigation. [30]

Most municipal water systems are built and maintained by local governments in accordance with state water laws. Because they apply to a moving resource that crosses state boundaries in rivers, streams and underground aquifers, state water laws have sparked numerous lawsuits and interstate quarrels, especially in parts of the West where water is scarce. [31] In 1935, for example, Arizona ordered National Guard units to the California border to protest construction of the Parker Dam, which would divert water from the Colorado River to Imperial Valley farms as well as Los Angeles itself. That “water war,” like myriad others, was settled in court. *

Some of the country's most heated water conflicts involve the Colorado River, which flows from the Rocky Mountains of Colorado and Wyoming (via the Green River, a Colorado River tributary) through some of the country's most arid and populous regions before crossing into Mexico and emptying into the Gulf of California. Under the 1922 Colorado River Compact, seven states agreed to evenly split rights to the river's annual flow — then at 15 million acre-feet — between the upstream states of Wyoming, Colorado, New Mexico and Utah and the downstream states of Arizona, Nevada and California. The agreement specified that the downstream states would always have the right to their allocated 7.5 million acre-feet, leaving the upstream states to use any surplus that might occur in wet years but use less than their allocated right in dry years. Because it was later discovered that 1922 was a wet year, the upstream states have frequently had to make do with less river water than they have a legal right to, igniting frequent interstate quarrels. [32]

Two decades before the compact was signed, the bureau was already beginning to build large water-supply projects in the West. The 1902 Reclamation Act authorized the Interior secretary to construct dams and other water-storage facilities to encourage farmers to “reclaim” and settle the arid region, which receives only one-third to one-half the precipitation that falls on Eastern states. Reclamation projects went up rapidly from the 1930s until the early '70s, and today the bureau operates about 350 reservoirs and 250 dams. Two of the dams, Hoover on the Colorado River and Grand Coulee on the Columbia, are among the largest in the world.

With most suitable waterways already developed, additional major projects were prohibitively expensive, and as a result construction slowed in the early 1970s. Meanwhile, the nascent environmental movement advanced different priorities for the West's waterways, such as

recreational use and conservation to protect fish and wildlife habitats. The 1970 National Environmental Policy Act further slowed new dam construction by requiring all federal agencies to conduct environmental-impact studies before embarking on new projects and by subjecting federal projects to greater public scrutiny. President Jimmy Carter declared in 1978 that affordability and environmental sustainability would be the top priorities for federal water policy.

President Ronald Reagan continued to oppose large water projects, and new construction of federal projects nearly ceased. Consistent with his desire to transfer many federal powers to the states, Reagan also abolished the Water Resources Council, a federal agency created in 1968 to assess the adequacy of the nation's water resources and coordinate interstate water policy.

Since the early 1990s, lawsuits brought under the 1973 Endangered Species Act increasingly have forced the Corps of Engineers and the Bureau of Reclamation to mitigate or prevent environmental damage caused by their projects. The law requires agencies to take necessary action to protect plants and animals threatened with extinction. Many of the bureau's efforts have focused on ways to restore populations of endangered salmon on the Columbia and Snake rivers, where bureau-operated dams impede the return of fish to upstream spawning grounds.

* China has continued the \$25 billion project — the world's largest hydroelectric facility. On June 1, the dam's gates were shut, and the giant reservoir began filling.

* The Supreme Court agreed with Arizona that the Bureau of Reclamation lacked authority to build Parker Dam, but Congress quickly authorized the project, forcing Arizona to join the Colorado River Compact to preserve its right to a portion of the river's water.

Current Situation

U.S. Drought Response

The drought of 2002 was one of the worst in U.S. history. East Coast cities shut down fountains, crops shriveled in the fields and suburban homeowners under watering restrictions watched their lawns and gardens dry up. Although abundant rains have eliminated water shortages in most of the East this year, many state and local governments are taking steps to be better prepared the next time drought strikes.

But the drought has lingered in the fast-growing Southwest. “In some cases we're in the fifth or sixth straight year of drought,” says the Bureau of Reclamation's Keys.

As water-supply concerns mount, more and more states — 35 to date — are adopting plans to prepare for future droughts. “In recent years states [have been] more proactive,” says Wilhite of the National Drought Mitigation Center. “They're moving from response planning, which is how you deal with a drought once you have one, to drought-mitigation planning, which is identifying and addressing your biggest vulnerabilities and putting in place comprehensive, early-warning systems. That enables states to reduce their risk to drought when it comes, rather than after it's here.”

So far, the federal government's role in drought planning is limited to jawboning. “The federal government has said it wants the states to prepare,” Wilhite says, “but there hasn't been a lot of national authority.”

After failing to win congressional approval last year, the National Drought Preparedness Act, reintroduced on July 24 by Sens. Domenici and Jeff Bingaman, D-N.M., may fare better this year. With little drought relief in sight, the Western Governors' Association has thrown its support behind the bill, and Wilhite predicts it would face little opposition.

“The Western governors, as well as the National Governors' Association, are now going beyond water management to emphasize the importance of drought planning,” he says. “I'm confident that the bill eventually is going to pass.”

Meanwhile, the federal government is promoting the more-efficient transfer of water in the 17 Western states where the Bureau of Reclamation has authority over water supplies. The agency is encouraging the spread of “water banks,” which would enable irrigation districts and other holders of capacity in its reservoirs to sell excess water to cities or other entities. Several reclamation water banks are already in operation, including one serving an irrigation district in southern Idaho that supplies water downstream in the Columbia River when it is needed to facilitate the salmon runs.

“Spaceholders have contracts that give them so much storage space in our reservoirs,” Commissioner Keys explains. “If there is more water in their spaces than they need, they can put

that into the water bank and sell it without affecting their contract or their state water rights.”

International Trends

Reflecting commitments enumerated in the 2000 Millennium Declaration, efforts are under way to halve by 2015 the number of people in the developing world who lack access to clean water and sanitation. “Today, more than in the past, there is an effort at the international level to try to meet those needs now,” says Gleick of the Pacific Institute.

Africa and Southern Asia face the most severe lack of water, but Gleick argues that the solutions vary across regions. “One of the things that we've learned in the last three decades is that there is no one solution to water problems,” he says. “What works in southern India may not work at all in sub-Saharan Africa.”

As the number of approaches to water crises has grown, so too has the number of agencies and companies involved in mitigating the shortages. While the World Bank once took the lead role, today there are hundreds of non-governmental organizations (NGOs) working at the village level, international engineering companies working at the dam-construction and water-treatment level, and private companies trying to get involved — though somewhat controversially. “The U.N. is very heavily involved,” Gleick says. “The principal international financial institutions — the World Bank, Asian Development Bank and International Monetary Fund — are supposed to be lending more in this area, though they actually haven't been.”

The era of huge hydro projects appears to be coming to an end as there are fewer and fewer waterways available to dam. But there are still some holdouts for the big-dam approach. The World Bank-funded Lesotho Highlands project continues, and although the bank pulled out of the massive Three Gorges Yangtze River dam due to international complaints about its severe environmental and social cost, the Chinese government has continued building it and recently began filling its massive reservoir. [\[33\]](#)

Pressure is mounting to encourage the lending institutions to play a bigger role in small-scale water projects as they move away from megaprojects. The African Development Bank's president, Oman Kabbaj, recently called for spending \$10 billion over the next seven years to help fund “sustainable” water supply and sanitation in rural Africa, with the overall goal of providing

freshwater access to all Africans by 2025. “This will be done by adopting a program approach — as opposed to single projects — and using technologies that are appropriate to local skills and knowledge,” Kabbaj said. [34]

In fact, many water projects now under way in the developing world focus on smaller-scale solutions. In southern India, for example, NGOs are helping villagers resurrect rooftop rainwater-collection tanks, an ancient technique that was all but abandoned when underground plumbing systems were built. But plumbing failed to reach the neediest households, so collection tanks are beginning to fill the gap.

“To me, this is pretty exciting technology,” says Engelman of Population Action International. “It’s very much community-based and helps solve the problem of water access at the household level.”

Another promising approach is the use of “gray water” — water that already has been used for washing — for purposes other than drinking. Japan and Singapore, which have long contended with limited water supplies, have installed parallel water systems that supply households with clean water for drinking and cooking and gray water for gardens and toilets. “Why should we flush toilets with water that’s been made potable?” Engelman asks. “That doesn’t make any sense, especially where water is in short supply.”

Outlook

Water Wars?

The Interior Department warns that 10 areas in seven Western states have a “substantial” to “highly likely” potential to erupt in conflict over water accessibility during the next quarter-century. [35] They include virtually all of the Southwest’s major metropolitan areas — Los Angeles, San Diego, San Francisco, Sacramento, Fresno, Las Vegas, Albuquerque, Santa Fe, Salt Lake City, Denver, Houston, Phoenix and Tucson — home to 40 million people. [36] Two of these hot spots — a 400-mile stretch of the Rio Grande and the point where the Colorado River flows from the California-Arizona border into Mexico — would involve international disputes with Mexico.

To avert future water wars, the Bureau of Reclamation wants Western states to improve conservation and continue developing water sales and transfers to move water from farms to the cities. To that end, the agency announced on July 3 that it would reduce California's allocation of Colorado River water to Imperial Valley farmers, leaving more for thirsty San Diego. Although the agency also promises to work cooperatively with water districts to settle disputes, the decision has sparked a heated debate among the state's water districts. [\[37\]](#)

“If we don't do something along the lines of our proposals in 'Water 2025,' those conflicts will be there, and they will multiply upon themselves,” warns Commissioner Keys. “If we can get folks working together and collaborating on solutions, we think that we can get by without crises or conflicts. So it depends on what we do.”

Gleick of the Pacific Institute hopes Americans will be able to conserve their way out of that grim scenario. “The United States is actually using less total water today than we used 20 years ago,” he says. “Per capita water consumption has gone down 20 percent. So we're already becoming more efficient.” The shift away from water-intensive manufacturing industries to less wasteful service industries has helped that trend, Gleick says. “We're producing more dollars per gallon of water used. This shows our potential to do more with less water, and that potential has just barely been tapped.”

Much more potentially violent conflicts may erupt in scores of countries around the world where water is a far scarcer commodity. Access to water is a rarely mentioned but central source of tension in the Israeli-Palestinian conflict, as Israel controls most of the water supplies on which Palestinians depend. Turkey's plans to dam the Tigris and Euphrates rivers have sparked charges by Syria and Iraq that Turkey is depriving them of water. Population growth in Sudan and Ethiopia is steadily reducing water flows in the Nile, raising protests from Egypt. The Ganges River is so depleted and polluted that its waters are barely usable by the time they reach Bangladesh. [\[38\]](#)

If water becomes scarcer, these and numerous other disputes could escalate into conflict, adding water to the list of reasons societies go to war. “Though there has been violence over water throughout history, there have not been wars over water to date,” Gleick says. “But the potential for political and even military conflicts over water is growing. I also think the potential for cooperation over water is growing. The challenge is figuring out how to reduce the risks of conflict.”

Population Is Key

A wild card in the water-scarcity equation is population growth. If the world's population continues to grow at the current rate, humans will consume 70 percent of all available fresh water by 2025, up from 54 percent today, according to the United Nations. Under this scenario, areas where water is already scarce would be ripe for conflict within the next two decades.

But recent population trends may yet save the world from thirst. “Demographers have been surprised by how rapidly the average human family is shrinking and how much later in their lives women tend to bear children compared with 30 years ago,” says Engelman of Population Action International. “Both of these trends are contributing to slower population growth in every part of the world, including many where water is particularly scarce.”

If the slowdown continues, population growth will actually halt around the middle of this century, Engelman says, reducing pressure on water supplies. “Population — more than water policy or technology — offers real hope for the future of water supply,” he says. “It's going to get worse before it gets better, but there's a good chance that all we have to do is get through this window where population and economic growth are contributing to more and more usage of water.

“If we can better manage the water supply that we currently have,” he adds, “[and] if we can learn how to use water much more efficiently, there's a good chance that we have all the water we need on this planet forever.”

Footnotes

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[3] See United Nations Educational, Scientific and Cultural Organization (UNESCO),

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[4] See United Nations, World Water Development Report, “Water for People: Water for Life,” March 22, 2003.

[5] See “Don't Drop Commitment to Conservation,” *Fort Collins Coloradoan*, June 15, 2003, p. 6B.

[6] See Erica Hartman, “Tidal Wave: International Movement Takes on the Water Industry,” *In These Times*, June 23, 2003.

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[11] See Lisa Davis, “It's a Bechtel World,” *San Francisco Weekly*, June 18, 2003.

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[15] See John Tierney, “Trying for Balance at the Interior Dept.,” *The New York Times*, June 9, 2003, p. A26.

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[17] See Thomas Hargrove, “Fish Case Raises New Squabble Over Water,” *Albuquerque Tribune*, July 23, 2003, p. A4.

[18] See Blaine Harden, “Judge Rules Plan Is Insufficient to Save Salmon,” *The Washington Post*, May 8, 2003, p. A3; and Eric Bailey, “U.S. Denies Blame for Salmon Die-Off,” *Los Angeles Times*, Oct. 3, 2002, p.

B1.

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[20] *Ibid*, p. 2.

[21] UNESCO, *op. cit.*

[22] See “Water and Industry,” UNESCO, www.unesco.org.

[23] For information on aquifer depletion in the U.S. Great Plains, see Brian Hansen, “Crisis on the Plains,” *The CQ Researcher*, May 9, 2003, pp. 434-435.

[24] U.N. World Water Development Report, *op. cit.*

[25] United Nations, “World Population Prospects: The 2002 Revision” (2003), <http://esa.un.org/unpp>.

[26] U.N., *op. cit.*

[27] *Ibid*, p. 11.

[28] World Commission on Dams, “Dams and Development: A New Framework for Decision-Making,” Nov. 16, 2000.

[29] See “To Talk about Jobs, Not Birds,” *The Economist*, Aug. 24, 2002, p. 38.

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[31] For background on U.S. water law, see Mary H. Cooper, “Global Water Shortages,” *The CQ Researcher*, Dec. 15, 1995, p. 1124.

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[33] See Jonathan Finan, “World Bank Focused on Fighting Corruption,” *The Washington Post*, July 4, 2003, p. E1.

[34] “Africa Needs \$10 Billion for Water, Sanitation,” Deutsche Press-Agentur, June 4, 2003.

[35] Interior Department, *op. cit.*

[36] See J. J. Johnson, “Water 2025: The Coming War on the Western Front,” July 11, 2003, *The Sierra Times* (www.sierratimes.com).

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Chronology

1900s-1920s

Federal government builds dams and reservoirs in the West to attract settlers.

1902

Reclamation Act authorizes the Interior secretary to construct dams and other water-storage facilities to encourage farmers to “reclaim” and settle the drought-prone West.

1922

Colorado River Compact allocates water rights among seven states.

1930s-1960s

Most of the world's 45,000 large dams are built.

1935

In an early U.S. water dispute, Arizona orders National Guard units to the California border to protest construction of the Parker Dam, built to divert water from the Colorado River to the booming city of Los Angeles.

1958

Federal Water Resources Council is created to assess the adequacy of water resources around the country and coordinate federal water policy.

1970s

Major environmental legislation affecting water quality goes into effect.

1970

The National Environmental Policy Act slows new dam construction by requiring all federal agencies to conduct environmental-impact studies.

1973

Endangered Species Act requires federal agencies to protect threatened or endangered plants and animals, affecting future decisions on allocation of irrigation and municipal water supplies.

1974

Safe Drinking Water Act allows the Environmental Protection Agency (EPA) to regulate the level of contaminants in drinking water.

1977

The first United Nations conference on water, held at Mar del Plata, Argentina, calls for a global inventory of freshwater. Clean Water Act authorizes the EPA to implement pollution-control programs, including setting wastewater standards for industry.

1978

President Jimmy Carter declares that affordability and environmental sustainability will be the top priorities for federal water policy.

1980s

As freshwater availability continues to dwindle in the developing world, the U.N. declares the “International Drinking Water and Sanitation Decade.”

Sept. 17, 1981

President Ronald Reagan abolishes the Water Resources Council, diminishing the federal role in water policy.

1990s

The world's population surpasses 5 billion, doubling in less than 40 years.

1992

An international water conference in Dublin, Ireland, concludes that water “should be recognized as an economic good,” a principle hotly debated at a U.N. conference that year in Rio de Janeiro, Brazil.

1998

Amid mounting criticism of costly “megaprojects,” the U.N. World Commission on Dams is established to assess the damage caused by massive water projects and consider alternative ways to make water accessible.

2000s

Water scarcity looms for much of the world.

September 2002

More than 20,000 endangered salmon die in the Klamath River after the Bureau of Reclamation diverts river water, already depleted by drought, for irrigation.

June 12, 2003

The 10th U.S. Circuit Court of Appeals rules that the Bureau of Reclamation must consider the effect on the endangered silvery minnow when it releases water from the San Juan-Chama Diversion Project for irrigation or municipal uses, opening the way for new challenges to water transfers based on the Endangered Species Act.

2025

The number of people with inadequate access to fresh water is expected to reach 2.6-3.1 billion, up from 434 million in 2003, according to Population Action International. The number of countries experiencing these conditions is expected to grow from 25 to 36-40 over the same period.

Pro/Con

Should federal water policy focus on increasing water supplies?

yes

Rep. John Linder, R-Ga.

*Sponsor, 21st Century Water Policy
Commission Act*

*From a statement posted at
linder.house.gov*

Water-resources managers will be faced with unavoidable, life-threatening challenges in the 21st century, and we must prepare for these challenges now through extensive research and coordination of objectives among all levels of water management — federal, state, local and the private sector. In the 107th Congress, I introduced legislation to begin this process and have introduced similar legislation in the 108th Congress.

All humans, plants and animals depend on clean, fresh water for survival, yet 97 percent of the Earth's water is saline. Two-thirds of Earth's fresh water is frozen in glaciers and polar ice caps, leaving only 1 percent to serve all human beings and plant and animal needs. Projections of future population growth and the resulting demand for increased water resources forecast imminent water shortages. The United States' water resources will be appropriated to their fullest capacity in the coming decades, and current water supplies will

no

Peter H. Gleick

*President, Pacific Institute, Oakland, Calif.
From Testimony Before the House*

*Resources Subcommittee on Water and
Power, April 1, 2003*

As we enter the 21st century, pressures on U.S. and international water resources are growing, and conflicts among water users are worsening. . . . Globally, the realization is growing that the failure to meet basic human and environmental needs for water is the greatest development disaster of the 20th century. Millions of people, mostly young children, die annually from preventable water-related diseases. Climate change is increasingly threatening our own water systems and water resources abroad. Controversy is developing over the proper role of expensive dams and infrastructure, private corporations and local communities in managing water. Yet the United States has not offered adequate leadership . . . to address these problems.

Here at home, municipalities are faced with billions of dollars of infrastructure needs and growing disputes over the role of public and private water management. Arguments among Western states over allocations of shared rivers are rising, as are tensions

prove inadequate.

While floods plague some regions of the country, droughts in other regions affect the lives of countless Americans. We have limited the amount of water allowed to circulate through our toilets. We have restricted outdoor water usage to specific days and times. Given these current restrictions, we must begin a coordinated effort to prepare for future water shortages now, before we are forced to limit our showers to three per week and to prohibitively restrict the water required to feed our nation.

The traditional methods of capturing and distributing fresh water within the United States will not be sufficient 20 years from now. Currently, roughly 50 trillion gallons of water fall on Georgia each year, yet our lakes are growing dangerously low, our citizens are subject to stringent water restrictions and our aquifers are being pumped dry. Why? Because we do not effectively capture Georgia's rainfall before it evaporates or runs off into the ocean. We must research new technologies, such as aquifer recharge, desalination, efficient irrigation techniques, recycled wastewater, wetlands creation and more in order to capture and store water for future usage. . . .

The engineering expertise exists to ensure

between cities and farmers over water rights. The U.S. and Mexico have unresolved disagreements over the Colorado and Rio Grande/Rio Bravo rivers, and our Canadian neighbors are concerned about proposals to divert Great Lakes or Canadian water for U.S. use. Communities are facing new challenges in meeting water-quality standards and ensuring that safe drinking water is available for all. . . .

I strongly support creation of a national [water] commission. I believe, however, that [Rep. Linder's] bill, as written, will not meet the needs of the nation. In particular, the “findings” of this bill are somewhat misdirected. . . .

In particular, the findings emphasize the need “to increase water supplies in every region of the country.” Overall water supply is not a problem, with some regional exceptions. And even in these regions, increasing supplies does not appear to be the most efficient, cost-effective and timely response. The greatest water problems facing the United States are not shortages, but inefficient use, inappropriate water allocations, water pollution and ecological destruction. Indeed, water use in the United States has decreased in the past 20 years, reducing pressure on overall supply. On a per-person basis, this decrease is substantial. . . . Per-capita use in the U.S.

future Americans access to fresh water. However, we need a comprehensive strategy . . . to implement this expertise. The 21st Century Water Policy Commission Act” is fundamental to meeting these objectives. We must no longer be reactive when faced with water emergencies. We must act now to face future emergencies proactively. Providing all Americans with fresh water is not a partisan issue. It is a matter of life and death.

has decreased 20 percent since 1980 — a remarkable change. . . . [T]otal economic growth in the U.S. has continued, even as overall water use has leveled off and even declined. Moreover, where the problem is “shortage,” the fastest, cheapest and most environmentally acceptable solution will not be an increase in “supply” but a reallocation of existing uses and improvements in efficiency.

Contacts

Bureau of Reclamation

U.S. Department of the Interior, 1849 C St., N.W., Washington, DC 20240
(202) 513-0575
www.usbr.gov.

Government agency responsible for maintaining water projects in 17 Western states. Its recent report, “Water 2025,” warns that water scarcity could heighten tensions in numerous Western communities unless they take steps to improve conservation and efficiency.

Pacific Institute for Studies in Development, Environment and Security

654 13th St., Preservation Park, Oakland, CA 94612
(510) 251-1600
www.pacinst.org.

A valuable source of information on global fresh water supplies and efforts to augment them.

Environmental Defense

257 Park Ave. South, New York, NY 10010
(212) 505-2100
www.edf.org.

Studies the impact of climate change and large dam construction on water supplies.

National Drought Mitigation Center

University of Nebraska, Lincoln, 239 L.W. Chase Hall, P.O. Box 830749, Lincoln, NE 68583
(402) 472-6707

www.drought.unl.edu.

Maintains the national drought map and provides extensive information on drought patterns.

Population Action International

1300 19th St., N.W., Second floor, Washington, DC 20036
(202) 557-3400

www.populationaction.org.

Studies the impact of population growth on natural resources, including fresh water.

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increase from 505 million in 2000 to between 2.4 billion and 3.2 billion by 2025.

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This exhaustive report on global water supplies was released at the Third World Water Forum, held this year in Kyoto, Japan.

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This report identifies numerous areas in the 17 Western states where the Bureau of Reclamation manages water projects that face increasing tension over allocation of precious water resources unless steps are taken to improve efficiency and conservation.

World Panel on Financing Water Infrastructure, “Financing Water for All,” March 2003.

Michel Camdessus, former managing director of the International Monetary Fund, chaired a panel that suggests that some \$180 billion a year must be invested in water systems in poor countries to overcome chronic water scarcity.

Next Step

Bureau of Reclamation

Murphy, Dean E., “California Report Supports Critics of Water Diversion,” The New York Times, Jan. 7, 2003, p. A12.

The federal government is embroiled in a lawsuit that aims to reduce water supplies to California farmers.

Murphy, Dean E., “In a First, U.S. Officials Put Limits on California's Thirst,” The New York Times, Jan. 5, 2003, p. A1.

The Department of the Interior has blocked Californians from dipping into the Colorado River for more than their allotted share of water.

Murphy, Dean E., “Judge Orders Change in Plan to Distribute Klamath River Water,” The New York Times, July 18, 2003, p. A12.

The Bureau of Reclamation is embroiled in a fight between conservationists and fishermen over water from the Klamath River, which runs through Oregon and California.

Perry, Tony, “Imperial Farmers Should Get Less Water, U.S. Report Says,” Los Angeles Times, July 4, 2003, p. B1.

The Bureau of Reclamation ruled that Imperial Valley farmers in California are guilty of wasting water and should have their mammoth allocation of the river reduced.

Drought

Gorman, Tom, “Fire Threat Is Red-Hot in Parched West,” Los Angeles Times, May 20, 2003, p. A12.

Spring rains bring new growth to the West, but by summer it will be fresh fuel for fire in the drought-plagued region.

Janofsky, Michael, “Arizona Awakens to Drought as Lakes Shrink and Harm Spreads,” The New York Times, Jan. 27, 2003, p. A16.

A persistent drought in large parts of the West is bearing down on Phoenix and Tucson.

Jehl, Douglas, “A New Frontier In Water Wars Emerges in East,” The New York Times, March 3, 2003, p. A1.

Tensions over scarce water resources in the East are the product of drought and development.

Manning, Carl, “Kansans Struggle Amid Drought,” The Washington Post, June 22, 2003, p. A19.

Years of below-average rainfall have stifled many businesses in southwestern Kansas.

Markels, Alex, “Water Fights,” U.S. News & World Report, May 19, 2003, p. 58.

Water shortages have cost western residents billions of dollars in water bills and shriveled vegetation.

Ritter, John, “Vegas Drought May Wither Growth,” USA Today, May 30, 2003, p. A3.

A drought in Las Vegas is stoking debate over a familiar Western topic: how an arid region can sustain bulging populations on tight water resources.

Global Water Shortages

“The Parched Earth,” The Economist, Nov. 23, 2002.

Apart from a few passing drizzles, it has not rained across most of Australia since February.

Forero, Juan, “As Andean Glaciers Shrink, Water Worries Grow,” The New York Times, Nov. 24, 2002, p. A3.

The shrinking of Andean glaciers could lead to water shortages in places like Bolivia and Peru, which need glaciers to supply water for drinking, irrigation and electricity generation.

Lacey, Marc, “Drought in Ethiopia Presages a Possible Famine,” The New York Times, Jan. 5, 2003, p. A6.

Drought and malnutrition are regular occurrences in Ethiopia.

Maharaj, Davan, “Hunger Gnaws at Ethiopia,” Los Angeles Times, May 19, 2003, p. A1.

Aid workers struggle to stave off a crisis after drought leaves millions of people needing food in Ethiopia.

Ray, Joydeep, “Drought in India Stirs an Echo of Grapes of Wrath,” Los Angeles Times, Jan. 26, 2003, p. A3.

Tens of thousands of Indians are on the move in search of water, food and survival

Wax, Emily, “Famine Returns to Ethiopia, A Land of Relative Plenty,” The Washington Post, Feb. 6, 2003, p. A32.

Because of severe drought, 11 million Ethiopians — about 16 percent of the population — face food shortages this year.

International Water Projects

“Damming Evidence,” The Economist, July 19, 2003.

Lending for big dams accounts for about 10 percent of the World Bank's portfolio, but 95 percent of its headaches.

Eckholm, Erik, “A River Diverted, the Sea Rushes In,” The New York Times, April 22, 2003, p. F1.

The pitfalls of large dams are notorious, and donor agencies like the World Bank have become more wary, requiring detailed assessments before massive water projects can begin.

Hessler, Peter, “The World's Biggest Dam Floods the Past,” The New Yorker, July 7, 2003, p. 28.

Both the U.S. government and the World Bank have refused to support China's Yangtze dam project because of environmental concerns

Privatized Water Systems

“Frozen Taps,” The Economist, May 31, 2003.

Privatization of water supplies works, as experiments with market-run utilities in England have borne out, says an editorial.

Barlow, Maude, and Tony Clarke, “Who Owns Water?” The Nation, Sept. 2, 2002, p. 11.

The World Bank and the U.N. consider water a “human need,” not a “human right,” a viewpoint that allows for private administration of water resources.

Finnegan, William, “Leasing the Rain,” The New Yorker, April 8, 2002, p. 43.

The world is running out of fresh water, and private companies and governments have begun the fight over controlling it.

Jehl, Douglas, “As Cities Move to Privatize Water, Atlanta Steps Back,” The New York Times, Feb. 10, 2003, p. A14.

Hundreds of American communities have hired private companies to manage their waterworks.

Knickerbocker, Brad, “Privatizing Water: A Glass Half Empty?” The Christian Science Monitor, Oct. 24, 2002, p. 1.

As cities contract out water service to private companies, some critics say prices will rise and quality will fall.

Lavelle, Marianne, et al., “The Coming Water Crisis,” U.S. News & World Report, Aug. 12, 2002, p. 22.

Many billions of dollars will be needed to quench America's thirst, but is private business the answer?

Tagliabue, John, “As Multinationals Run the Taps, Anger Rises Over Water for Profit,” The New York Times, Aug. 26, 2002, p. A1.

As some Latin American countries are ceding control of public water utilities to private, for-profit ventures, activists and protesters have begun to mobilize.

Western Water Wars

Booth, William, “As Lake Falls, Debate Over Glen Canyon Rises Anew,” The Washington Post, April 27, 2003, p. A3.

That giant sucking sound in the West is the unprecedented emptying of Lake Powell, the critical and controversial Colorado River reservoir that is draining rapidly.

Boxall, Bettina, “Thirsty Colorado Is Proposing to Stick a 'Big Straw' Into Its Namesake River,” Los Angeles Times, July 12, 2003, p. B1.

California's prodigious thirst looms large in Western water policy and is driving other states toward guarding their own water supplies.

Janofsky, Michael, “In the Dry, Dry West, A Search for Solutions,” The New York Times, June 2, 2003, p. A13.

Cities and counties in many Western states are stepping up efforts to monitor car washing, lawn watering and other non-essential water uses, in light of water shortages.

Kriz, Margaret, “Water Wars,” The National Journal, March 8, 2003.

After Southern California missed the deadline for reallocating its water, the Environmental Protection Agency stepped in to regulate water distribution.

Mohan, Geoffrey, “Farm Town Withering on Vine,” Los Angeles Times, July 2, 2003, p. B1.

Some California farm towns are failing — the result of years of poor irrigation practices — which have turned much of the land here into a salty wasteland.

Vesbach, Jeremy, “Tiny Fish Could Pull Plug on City's Water Plan,” The Christian Science Monitor, May 21, 2003, p. A3.

Albuquerque, New Mexico's largest city, is running out of groundwater and plans to begin drawing water from the Rio Grande River in 2006.

Special Focus

Global Warming Threatens Water Supplies

Controversies Growing Over Water Transfers

Global Warming Threatens Water Supplies

For more than a decade, scientists have observed a gradual rise in Earth's average surface temperature. [1]There is wide — though not unanimous — agreement that the main source of global warming is the burning of fossil fuels — oil, coal and natural gas — to run vehicles, power industry, generate electricity and heat buildings. Burning fossil fuels releases carbon dioxide and several other so-called greenhouse gases, which trap the sun's heat inside Earth's atmosphere, much as glass traps heat inside a greenhouse.

While the rise in temperature — estimated at about 3 to 6 degrees Fahrenheit by the end of the century — may seem insignificant, scientists warn it could have a dramatic and possibly catastrophic effect on the global environment. One of the biggest impacts could be on the world's supply of fresh water.

Rising surface temperatures melt glaciers and permanent snow cover in the polar regions and on high mountaintops. As polar ice melts into the oceans, sea levels rise, threatening to flood coastal areas and islands. Seawater already is beginning to encroach on fresh water aquifers on some Pacific islands, such as Palau and Samoa, while the Netherlands, much of it below sea level, is bracing for new assaults on its legendary system of dikes. [2]

Melting of glaciers also is beginning to threaten water supplies. As Himalayan snow and ice disappears, so does the high-altitude vegetation needed to slow runoff to the Ganges and other rivers of the Indian subcontinent. That, in turn, leads to recurrent cycles of flooding and low water levels in downstream areas of India and Bangladesh. [3] Similarly erratic water-supply patterns are being observed in regions along South America's Andes range and the Rocky Mountains in the United States and Canada. [4]

Global warming also is altering the world's precipitation patterns, scientists say. The tropics and subtropics are expected to receive lower and more erratic rainfall in coming decades, while the United States and other temperate zones are expected to experience more rain and snow. Warming is also expected to increase the frequency of extreme weather events, such as floods, droughts, typhoons and hurricanes. At times of drought, stream water may diminish and carry higher concentrations of pollutants, reducing still further the amount of usable fresh water.

On the positive side, rising temperatures may increase the amount of land that can be used for food production in the future by warming well-watered regions in northern Canada and Siberia that currently are too cold for agriculture. But at the same time there already are signs that warmer temperatures are accelerating drought and desertification in food-producing regions of Africa. [5] Indeed, the overall impact of global warming on water supplies is expected to be negative. The United Nations predicts that climate change alone will account for about 20 percent of the expected increase in global water scarcity. [6]

Climate experts say the combination of climate change and increased global demand for water makes it all the more urgent to find ways to improve access to clean water.

“There's more and more concern that future climate patterns may not reflect what we've seen in the past,” says Don Wilhite, director of the National Drought Mitigation Center in Lincoln, Neb. “We really need to be looking at some other scenarios of future climate, which may include more

extreme weather events and more variability. With more and more of us trying to live on finite water resources, climate change amounts to a double whammy for future water resources.”

[1] For background, see Mary H. Cooper, “Global Warming Treaty,” *The CQ Researcher*, Jan. 26, 2001, pp. 41-64.

[2] See William C. G. Burns, “Pacific Island Developing Country Water Resources and Climate Change,” in Peter Gleick *et al.*, *The World's Water* (2002), pp. 113-131.

[3] See “The Ganges: Troubled Waters,” *BBC News*, June 27, 2000.

[4] See Juan Forero, “As Andean Glaciers Shrink, Water Worries Grow,” *The New York Times*, Nov. 24, 2002, p. A3; and Dan Vergano, “Global Warming May Leave West in the Dust,” *USA Today*, Nov. 21, 2002, p. D9.

[5] See Michael Grunwald, “Bizarre Weather Ravages Africa's Crops,” *The Washington Post*, Jan. 7, 2003, p. A1.

[6] United Nations, “Water for People, Water for Life,” *World Water Development Report*, executive summary, p. 10.

Controversies Growing Over Water Transfers

In the arid Southwestern United States, thirsty cities acquire more and more of their water from distant rural areas where rivers and streams contain more water than residents consume for agriculture, ranching and commercial or household use. These so-called interbasin transfers involve the use of pumping stations and conduits, occasionally tunneling through miles of mountainous terrain.

At a time of growing water scarcity, transfers are becoming increasingly common — and controversial. Along the highway that runs beside the headwaters of the Arkansas River in central Colorado, signs protest efforts by Denver and other Front Range cities along the Rocky Mountains' eastern slope to divert more of the region's pristine waters. In the summer tourist season, local whitewater-rafting outfitters rely on high water, and environmental advocates warn that depleting the river further will threaten the mountain-river ecosystem. [7]

“Transfers are very controversial because our future economic development, our agricultural and ranching heritage — not to mention a rapidly growing tourist economy — all need water,” says Carrie Doyle, program manager of the League of Conservation Voters in Denver. “That all this could be lost or diminished in order to water lawns on the Front Range is something that doesn't sit well with Western Slope folks.”

But Peter Binney, utilities director in Aurora, a Denver suburb that has long depended on water transfers to fuel its rapid growth, says they are beneficial for both parties. “Water rights are one of the most valuable assets farmers who are moving away from cropping possess,” he says. “If they decide to market those rights, we will agree to revegetate those fallow fields with native grasses, which use a third of the water needed to grow crops, and transfer the excess two-thirds of the water to the city for municipal use.”

As fast-growing cities outstrip their water resources, controversies over water transfers are spreading beyond the Southwest. Atlanta Mayor Bob Young recently told a House subcommittee how communities in Georgia's Savannah River basin fought off efforts to transfer Savannah River water to the adjacent Chattahoochee River basin, where fast-growing Atlanta was running short of water. “The premise of interbasin transfers is that a watershed with excess supply will be tapped to subsidize a shortage of water in a neighboring watershed,” Young said. “Such an approach penalizes regions that apply good planning and smart-growth principles and rewards communities that grow and expand without regard to whether existing water supplies will support the development.” [\[8\]](#)

The Savannah River dispute was resolved when Atlanta dropped its water-permit application, and the Georgia General Assembly sought to avert future disputes by passing a bill discouraging future interbasin transfers and limiting such transfers to counties adjacent to the watershed in question. But Young warned that state legislatures are powerless to resolve disputes over watersheds that cross state lines. “Cross-border communities are virtually helpless when it comes to influencing the legislative and administration process in another state,” he said.

A case in point is the ongoing dispute between Virginia and Maryland over rights to water flowing in the Potomac River, which separates the two states. When Virginia proposed moving a water-intake pipe farther toward the middle of the river to provide more drinking water for its share of the rapidly expanding Washington, D.C., suburbs, Maryland refused to allow the move, citing a

1632 grant by England's King Charles I giving it sole control over the Potomac. Citing subsequent U.S. Supreme Court rulings granting Virginia a share of the river's water, Virginia sued, and the Supreme Court is once again considering the dispute. [9]

[7] For a detailed account of Colorado water transfers, see Todd Hartman, "Dividing the Waters," *Rocky Mountain News*, July 11, 2003, p. 1W.

[8] Young testified before the House Transportation and Infrastructure Subcommittee on Water Resources and Environment on June 4, 2003.

[9] See Fred Bayles, "Living in a State of Uncertainty," *USA Today*, July 21, 2003, p. 3A; also Douglas Jehl, "A New Frontier in Water Wars Emerges in East," *The New York Times*, March 3, 2003, p. A1.